MARGARINE
AND THE
VITAMIN PROBLEM

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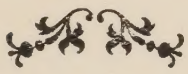

PLANTERS FOODS LIMITED,
BROMBRO PORT,
CHESHIRE.

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INTRODUCTION

THE health and beauty and happiness of every individual and every race depend primarily upon the supply of enough of the best food. Civilized man, living in crowded cities where no food is produced but vast quantities must be consumed, has largely gone astray in certain vital particulars of diet, and suffers accordingly from many diseases of civilization, as they have rightly been called. These keep the surgeons, the children's doctors, the directors of hospitals and sanatoria, the druggists and the undertakers, very busy. They are unnecessary because they are wholly preventable. Many of the worst are, in whole or in part, due to absence or shortage of certain vital factors of diet, called vitamins, discovered in England some fifteen years ago. Our diet in this country conspicuously lacks the most important of these vitamins, and hence we have, for instance, beyond question the worst teeth in the world, whilst rickets is known everywhere on the Continent as the English disease. The problem is largely one of a vast and crowded population, which cannot obtain, on feasible economic terms, vast supplies of the expensive foods which contain these precious substances. The facts were very formidable during the war, and would long continue to be so, as the Imperial Economic Committee has plainly stated (see page 16), were it not for the successful issue of prolonged research which has solved the problem, as we shall now proceed to show. It is all a question of enough of the right fat : fat that is more than fat in virtue of the potent, constructive, protective vitamins without which the body cannot grow, could not resist disease if it could grow, and could not reproduce itself even if it could grow and reach maturity.

THE REQUIREMENTS OF A BALANCED DIET

The human body requires an adequate supply of fat for life. The essentials of any diet may in fact be expressed in terms of (1) protein, (2) fat, (3) carbohydrate, (4) inorganic substances (i.e., water and mineral salts), and (5) accessory food factors or vitamins. A typical daily diet should supply the following amounts in ounces dry weight :

Protein	*Fat*	*Carbohydrates*
4	3	15

In other words, a normal adult doing a fair amount of physical work would require about 1 lb. lean beef, 3.7 oz. butter or margarine, and 28 oz. of bread per day.

THE FAT REQUIREMENT AND THE FAT SUPPLY

In the matter of fatty foods we are as a nation admittedly under-nourished. Our requirement of fat in terms of butter or margarine (containing 80 per cent. fat) is 3.7 oz., while our consumption (1925) is 0.7 oz. butter and 0.5 oz. margarine—a total of 1.2 oz. per head per day. There is thus a deficit of no less than 2.5 oz. per head per day. Part of this deficit is certainly made up from fat eaten with other constituents of the diet, but to give the fat equivalent of even 2 oz. butter or margarine the following amounts of common foods would have to be consumed :

	Ozs.
Lean beef	50
Lean mutton	35
Lean bacon or pork	25
Eggs	20
Milk	60
Cheese	6
Oatmeal	25
Bread	1,000
Potatoes	600

Evidently the average consumption of fat in all forms in this country is below the normal, and indeed we suffer accordingly in our nutrition and health from this fat deprivation, which is largely due to the fact that butter as an article of heavy consumption is beyond the means of the great mass of the consuming public. It is, therefore, easy to understand that margarine as a cheaper alternative to butter received every encouragement from those who had the best interests of the community at heart.

The rise in the production and consumption of margarine since 1870, when it was first introduced into the French Navy as a war measure, has been continuous and rapid. Improvements in process and quality have accompanied this rise, and have left little to be desired, so far as the better grades are concerned. To-day such a world-famous butter-producing country as Denmark consumes no less than 45 lb. of margarine per head of its population per annum. That such a thing is possible, in the very home of butter, is surely a testimonial of quality.

THE FUNCTIONS OF FATTY FOODS IN THE DIETARY

The functions of fatty foods may be summarized under three headings :

(1) They provide the body with its best source of heat and energy ;

(2) They help to regulate and control the rate of digestion of other foods ;

(3) They act as carriers of the accessory factors or fat soluble vitamins A and D.

Fats share with carbohydrates the function of providing the body with suitable sources of energy and heat. As fuel or energy foods, fats are two and a quarter times as valuable as carbohydrates, weight for weight, and therefore, from the purely energy point of view, the two foods can be proportionately interchanged. Normally, edible fats are much more expensive than carbohydrate foods. Thus, 1 lb. of edible fat in the form of butter costs approximately 2s. ; in meat or bacon it costs as much if not more, while in its cheapest form as margarine the cost is approximately 1s. Now carbohydrate food in the form of, say, flour, can be had at 2d. per lb., or allowing $2\frac{1}{4}$ lb. of starchy food per pound of fat, energy in the form of starchy food costs $4\frac{1}{2}$d., while in the form of fat it costs from 1s. to 2s. There is thus a continuous economic pressure putting a premium on the consumption of the less expensive carbohydrate food. This is a serious matter, since, as already pointed out, our consumption of fat is far below the physiological normal.

Oils and fats perform a useful function in controlling the rate of digestion. They are themselves very gradually digested, absorbed and utilized, and they prevent the over-rapid digestion of other foods taken with them. Their natural place in the dietary is in association with carbohydrate foods, since, in order to enable the body to deal with fats, a proportion of carbohydrates is necessary. Fat dyspepsias, called "bilious attacks" by the public and "ketoses" by the doctors, may often be relieved or cured by partaking freely of sugary or starchy foods. Bread and butter or margarine are therefore a

fully justified combination and one which meets the material needs of the body.

There is one more leading consideration, and that is as regards the form in which fatty foods are presented for consumption. They must be attractive and easily digested. It is only under the most rigorous conditions, i.e., within the Arctic or Antarctic Circles, that pure or naked oils and fats can be consumed as such with relish. Otherwise butter, margarine, cream, or mayonnaises are demanded and must be supplied. Butter and margarine are particularly suitable, since they can readily be combined, as, e.g., with bread, cereal meals, or potatoes, and so fitted into their natural place in the dietary, in combination with carbohydrate foods.

THE FAT SOLUBLE VITAMINS

Vitamin A is known as the growth-promoting vitamin, while vitamin D prevents rickets and has been called the antirachitic vitamin. Vitamin D—sometimes also called the calcifying vitamin—has been well named from its function, which is to promote calcification of bone. In its absence or even relative deficiency bones and teeth do not develop normally, even when the food contains all the other nutriment necessary.

The function of vitamin A is not completely described by calling it the growth-promoting vitamin. Certainly in its absence growth ceases, but a no less important fact is that there is also a tendency for many diseases to develop. It is a protective vitamin, and foods abundant in it are protective foods. Certain forms of blindness are common both in experimental animals and in human beings whose diet, purposely or otherwise, does not furnish them with sufficient vitamin A. The resistance to other diseases, those most characteristic of our country,

is also reduced. Bronchitis, pneumonia and tuberculosis, the deadly respiratory diseases, attack the unprotected victim. Thus, while symptoms of vitamin D deficiency may be looked for in skeleton defects, malformed limbs, jaws or teeth, the effect of vitamin A deficiency is most apparent in susceptibility to the minor and some of the major ills of life. Wherever, in this country or abroad, any success is obtained in the treatment of consumption, the foods rich in vitamin A are chiefly relied upon. Lack of such foods, after the war, killed hosts of hapless Viennese.

BUTTER AS A SOURCE OF FAT SOLUBLE VITAMINS

Butter (and dairy produce generally) has undoubtedly been our main stand-by for vitamins A and D in the past. Butter suffers, however, in this respect, from two great defects. It is not potent enough in the amounts at present consumed to provide all that is necessary, and it is extremely variable in its vitamin potency. The list given below gives some idea as to the relative A and D potency of a few well-known substances :

Foodstuffs.	*Relative strength as compared with summer butter.*
Cod-liver oil . . .	20 to 50 times as potent as summer butter.
Fish roes, fatty fish, and egg yolk Viking margarine	Equal to summer butter.
Winter butter Oleo and butter-blended margarines Beef suet	From 1/10th to 1/100th summer butter.
Lard White, non-oily fish : cod, etc. Vegetable margarines	Practically non-potent.

Cod-liver oil, though included in the food substances above, cannot be regarded as a normal food. It is nauseous, often intolerable and ruinous to the digestion. Summer butter may be given the value 1, and as such comes into the same category as Viking margarine, egg yolk, fish roes and fatty fish such as herrings. The fact that winter butter has but a tenth of the potency of summer butter contributes to our dreadful winter death rate. Stall-feeding on dry fodder does not provide the dairy cow with the necessary vitamins; she cannot manufacture them, and her milk and butter are consequently deficient. Winter butter may be, and indeed often is, of little, if any, greater vitamin potency than margarine, as manufactured before the introduction of Viking. The only margarine to have a vitamin value comparable to summer butter is Viking margarine—a new product developed on the lines explained below.

MARGARINE AND VITAMINS

One of the first revelations which followed the discovery of vitamins was that while butter contains certain of these accessory factors, margarine does not. All vegetable oils (except red palm oil) are practically devoid of vitamins. On the other hand, the vitamin-rich oils (cod-liver oil, whale oil, and red palm oil), if incorporated into margarine in sufficient amount to give a reasonably high vitamin potency, ruin it for the palate The efforts of the more progressive margarine manufacturers to overcome this vitamin difficulty and to put their product on an equality with butter in this important respect have as a matter of fact been continuous and strenuous. The whole world has been searched for suitable edible oils rich in vitamins, and the search till recently revealed only the so-called oleo or animal oils, and butter itself. From the table of values already given it is apparent that a

margarine made entirely from animal oils and fats can have at most a vitamin value only a fraction of that of good butter, and the same is true of margarine made up to the full 10 per cent. of butter, which is the maximum addition permitted by law.

Intensive research has, however, solved the problem and produced a margarine as rich in vitamins as summer butter. This margarine has been called " Viking."

VIKING MARGARINE AS A STANDARD VITAMIN PRODUCT

Viking margarine has been standardized to contain during the whole year as much vitamin A and D as summer butter, and is at the same time made from ingredients which enable more than the normal attractiveness and digestibility of the product to be retained. As a result of continuous research we have produced an attractive edible oil as rich in vitamins as cod-liver oil, and this in turn has solved the problem of producing a vitamin-rich margarine. The development of the vitamin research which produced Viking margarine was roughly as follows :

It was discovered, in the first place, that the taste of vitamin-rich oils had nothing to do with the vitamins, but was a property of the highly unsaturated fatty acids which go to make up most vitamin-rich oils. These strongly tasting bodies in turn were shown to have no particular nutritive function. In the next place, the vitamins were found to be associated not with actual oils but with a certain proportion (from one to two per cent.) of non-fatty or unsaponifiable matter which oils normally contain.

As an outcome of work which, in itself, can now be described in a single paragraph, but which as work took up more than eight years of continuous effort, we are

now in a position to produce a stable, tasteless, edible oil, rich in vitamins and in every way suitable for use in margarine. A further difficulty attended the introduction of this vitamin-rich oil into margarine in such a way as to retain its full health-giving properties. This last difficulty has now been surmounted and our work is complete in all details.

FEEDING RESULTS

The only methods by which vitamins can be recognized are by feeding experiments. Even where most abundant, vitamins are present in such small amounts that they cannot yet be isolated and studied as chemical entities. To test for them by feeding, experimental subjects are put on diets perfectly complete in all details except that the particular vitamin or vitamins to be tested for are absent. When growth ceases, or a weight decline sets in, the particular food that it is required to test is added. From the result obtained and from the amount of the food necessary to give a positive result, a roughly quantitative idea may be formed as to the vitamin potency or otherwise of the food.

Thus when A and D vitamins are being tested for, the subjects for test, which are young and growing, are selected and kept on complete but vitamin A- and D-free diets until a weight decline sets in. Other symptoms may appear, particularly an eye disease, called xerophthalmia. After addition of the test food, growth should recommence. All symptoms should disappear, and further development should, in fact, be normal. In particular the bones and skeleton should be perfectly formed and fully calcified. If vitamins A and D are absent from the test food there is progressive loss of weight, the eye trouble becomes worse and may result in blindness, while the bones of the skeleton and the teeth are found to be too

soft and very badly calcified no matter how abundant the lime salt in the foods. This is rickets, the notorious " English disease " which affects millions of our nation's children.

In the course of our work we have conducted thousands of such feeding trials, and as a result of them and from published information, the table already given on page 10 has been compiled. The information given may be expressed in another way, i.e., as the minimum amount of the test food which will bring about the necessary curative effect under the conditions specified.

Foodstuffs.	*Minimum Curative Dose.* (*Milligrammes*)
Viking vitamin oil .	From 1.0 to 3.0 (1/20th to 3/20th drop).
Cod-liver oil . . .	From 2.0 to 5.0 (1/10th to 1/4th drop.)
Viking margarine. Summer butter .	0.1 gramme (5 drops).
Winter butter . .	1.0 gramme (50 drops).
Beef suet . . Margarines in general	More than 2 grm. (Often more than fat tolerance of animal)

Viking vitamin oil is the name by which we describe our vitamin-active edible oil, which we incorporate into Viking margarine. Typical average growth curves for some of the substances mentioned above are given in figs. 1 and 2.

The figures are largely self-explanatory. Days are represented horizontally and weight increases vertically. Normally, from the commencement of the feeding on vitamin A- and D-free diet until a conclusion is arrived at, there elapses a total period of from 2 to 3 months. As shewn, there is first of all on vitamin A- and D-free diets a regular growth increase in the young animal during the time they are using up their stored vitamins. This is followed by a definite drop in weight coincidin

FIG. 1

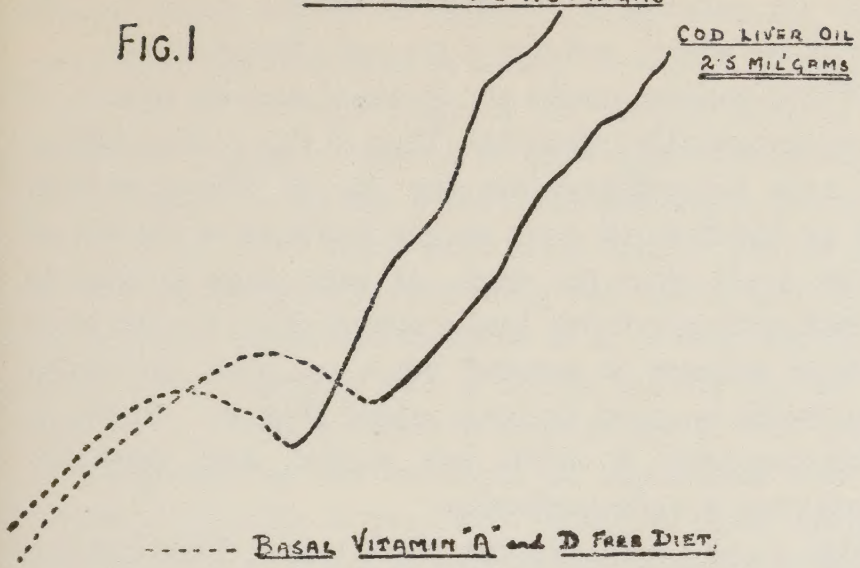
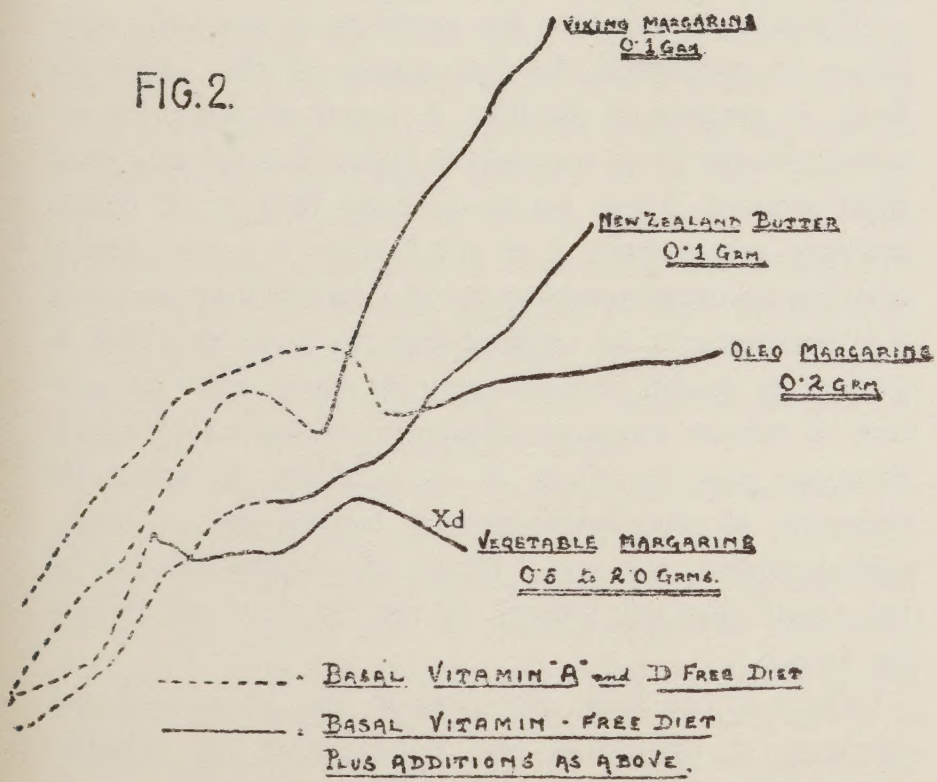

VIKING VITAMIN OIL 2·5 MILGMS
COD LIVER OIL
2·5 MILGMS
------ BASAL VITAMIN "A" and D FREE DIET.
——— BASAL VITAMIN - FREE DIET
PLUS ADDITIONS AS ABOVE.

FIG. 2.



X · XEROPHTHALMIA d · DEATH

with the exhaustion of the store. At this point the test foods are added, and this is the only change made.

Where positive results are obtained they are usually of a most impressive character. Thus in Fig. 1 the addition of only 2.5 milligrammes per day of Viking vitamin oil or cod-liver oil gives weight increases at the rate of from 10-15 grm. per week, or even more in animals which were previously losing weight (Fig. 1). The same rate of increase is secured when 0.1 grm. of Viking margarine or good butter is added (Fig. 2). In Fig. 2 oleo-margarine is much less potent, and vegetable margarine is quite ineffective.

Figs. 1 and 2 epitomize the whole work. They indicate quite clearly that the solution of an extremely important and difficult problem has been achieved. That the problem is really important is borne out by the two selected official pronouncements printed below :

" Recent research into the problem of nutrition continues to emphasize the importance of the ' infinitely little ' in matters of dietetics. A fourth vitamin, the so-called vitamin D or antirachitic factor, has recently been distinguished. These accessory food factors, of whose intimate nature little is as yet known, are now recognized as essential constituents of a satisfactory diet, and it is becoming to be realized that the value of a diet in preserving health depends quite as much upon its content of minute amounts of certain substances of which vitamins may be taken as an example, as upon the presence of the better-known constituents, protein, carbohydrates, and fats." (From the Annual Report of the Chief Medical Officer of the Ministry of Health for 1925.)

" There is but little difference in the fat and protein contents of margarine and butter, and the calorific equivalents of the two substances are approximately

equal. It is in regard to vitamin values, however, that these two foodstuffs differ so widely. In our Dairy Report we refer to the importance of the vitamin content of butter and cheese in relation to growth and health. Here it is sufficient to say that while butter manufactured from the milk of cows which have been suitably pasture fed is rich in the growth-promoting and antirachitic (i.e., fat soluble) vitamins, margarine as at present manufactured from vegetable oils is almost entirely devoid of both. . . . The question of improving the food value of margarine by the inclusion of ingredients rich in vitamins, in order to produce a substance equal in food value to butter, is one of considerable importance from the point of view of national health standards. *This is a matter to which research could very profitably be directed.* . . . The vitamin content of butter is high when it is made from the milk of meadow-fed cows, but the vitamin content of margarine made from vegetable oils is almost negligible. It follows that margarine is a useful food for adult persons, especially for muscle workers, but because of its vitamin deficiency inferior to butter, even for adults, and very definitely so for children. . . . The chief problem of research in connection with margarine is the discovery of some palatable oil rich in vitamins, and suitable for mixture with other ingredients." (Fourth Report—Dairy Produce—of the Imperial Economic Committee—H.M. Stationery Office.)

From the above extracts it is apparent that the authorities responsible for our public health and economic welfare are fully alive to the importance of vitamins, and to the importance also of encouraging and endowing research to solve the problem of making margarine as rich in vitamins as butter. *We have found the palatable oil rich in vitamins; we have incorporated it into Viking margarine, and we have thus made margarine equal to the very best butter.*

PLANTERS FOODS LIMITED,
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